

NAME:
PERIOD:
DATE:

Statistics Tutorial: Poisson Distribution

Attributes of a Poisson Experiment

DO NOW: 14DEC 2010

Copy the definitions from the board.

A **Poisson experiment** is a **statistical experiment** that has the following properties:

- _____

- _____

- _____

- _____

Note that the specified region could take many forms. For instance, it could be a length, an area, a volume, a period of time, etc.

Notation

The following notation is helpful, when we talk about the Poisson distribution.

- e : _____
- μ : _____
- x : _____
- $P(x; \mu)$: _____
- experiment, _____

Poisson Distribution

A **Poisson random variable** is the number of successes that result from a Poisson experiment.

The **probability distribution** of a Poisson random variable is called a **Poisson distribution**.

Given the mean number of successes (μ) that occur in a specified region, we can compute the Poisson probability based on the following formula:

Poisson Formula. Suppose we conduct a Poisson experiment, in which the average number of successes within a given region is μ . Then, the Poisson probability is:

where x is the actual number of successes that result from the experiment, and e is approximately equal to 2.71828.

The Poisson distribution has the following properties:

- _____
- _____

Example 1

The average number of homes sold by the Acme Realty company is 2 homes per day. What is the probability that exactly 3 homes will be sold tomorrow?

Solution: This is a Poisson experiment in which we know the following:

- $\mu =$ _____
- $x =$ _____
- $e =$ _____

We plug these values into the Poisson formula as follows:

Poisson Calculator

Clearly, the Poisson formula requires many time-consuming computations. The Stat Trek Poisson Calculator can do this work for you - quickly, easily, and error-free. Use the Poisson Calculator to compute Poisson probabilities and cumulative Poisson probabilities. The calculator is free. It can be found under the Stat Tables tab, which appears in the header of every Stat Trek web page.

Poisson Calculator

Cumulative Poisson Probability

A **cumulative Poisson probability** refers to the probability that the Poisson random variable is greater than some specified lower limit and less than some specified upper limit.

Example 2

Suppose the average number of lions seen on a 1-day safari is 5. What is the probability that tourists will see fewer than four lions on the next 1-day safari?

Solution: This is a Poisson experiment in which we know the following:

- $\mu =$ _____
- $x =$ _____

- $e =$ _____

To solve this problem, we need to find the probability that tourists will see 0, 1, 2, or 3 lions. Thus, we need to calculate the sum of four probabilities: $P(0; 5) + P(1; 5) + P(2; 5) + P(3; 5)$. To compute this sum, we use the Poisson formula:

Thus, the probability of seeing at no more than 3 lions is 0.2650.

DO Now: 15DEC2010

Complete the following Problem:

The number of traffic accidents per week in a small city has a Poisson distribution with mean equal to 1.3. What is the probability of at least two accidents in 2 weeks?

- (a) 0.2510
- (b) 0.3732
- (c) 0.5184
- (d) 0.7326
- (e) 0.4816

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Complete the following problem

The number of deaths due to stroke in the Vancouver region each year varies randomly with a mean of about 555 deaths per year. Assuming that the number of deaths has an approximate Poisson distribution, then the probability that there will be at least 600 deaths due to stroke in any one year is:

- (a) about 1%
- (b) about 32%
- (c) about 16%
- (d) about 5%
- (e) about 2.5%

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Collect the Quiz sheet from the front of the class.